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Marine Casualty Investigations

Enquêtes sur les accidents maritimes

REPORT OF INVESTIGATION INTO THE STRIKING OF THE NEW WESTMINSTER RAILWAY BRIDGE, NEW WESTMINSTER, B.C., BY THE BARGE "SEASPAN 270" WHILE UNDER TOW OF THE "SEASPAN MONARCH" ON JUNE 4, 1986.

REPORT No. 471

Investigation Report to the Minister pursuant to sections 542 or 545 of the Canada Shipping Act

Rapport d'investigation au Ministre conformément aux articles 542 ou 545 de la Loi sur la marine marchande du Canada

Canada

Ce rapport est aussi disponible en français.

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REPORT OF INVESTIGATION INTO THE STRIKING OF THE NEW WESTMINSTER RAILWAY BRIDGE, NEW WESTMINSTER, B.C., BY THE BARGE "SEASPAN 270" WHILE UNDER TOW OF THE "SEASPAN MONARCH" ON JUNE 4, 1986.

Particulars of Vessels

Name	Tug "SEASPAN MONARCH" ex "HAROLD A.JONES"	Barge "SEASPAN 270" ex "GENMAR 101-80"
Official Number	326548	356744
Port of Registry	Vancouver, B.C.	Vancouver, B.C.
Call Sign	VGGW	-
Gross Tonnage	517.6	7692
Net Tonnage	72.0	6327
Length, overall	41.86 m	121.93 m
Breadth	9.48 m	30.54 m
Depth	4.83 m	6.03 m
Draught (at time of incident)	4.27 m forward 4.93 m aft	2.23 m forward 2.65 m aft 2.44 m mean
Type	Steel tug	Steel barge
Crew	9	None
Built	1966, New Westminster, B.C.	1976, Tsu City, Japan
Propulsion	2 Werkpoor diesel engines with a combined 2611 kW power, driving 2 fixed pitch propellers and controlled from the wheel-house	None
Cargo	None	None (5081 tonnes of water ballast)
Classification (both vessels)	Lloyds Register of Shipping	
Owner (both vessels)	Seaspan International Limited North Vancouver, B.C.	

NOTE: 1. All times in this report are expressed in Pacific Daylight Saving Time (UTC minus 7 hours).

2. A glossary of abbreviations and terms can be found following the Findings in this report.

Background

At 2245 on June 4, 1986 the tug "SEASPAN MONARCH" departed Leader Avenue dock on the Fraser River in Coquitlam, B.C. bound for Victoria, B.C. with the unloaded, but ballasted, barge "SEASPAN 270" in tow.

Due to the high water level and freshet in the river, four additional tugs were ordered to assist the "SEASPAN MONARCH" with her tow when approaching and passing through the Canadian National Railway swing-bridge channel at New Westminster. On approaching the bridge, the barge sheered to starboard and struck the south-east corner of the bridge protection pier and the opened bridge swing span. The bridge, which is a vital link in the railway transportation system serving Vancouver, sustained damage to its protection pier and swing span and the barge suffered minor structural damage to her bow and port quarter.

There were no injuries nor was there any pollution as a result of this incident.

Narrative

The crew of the tug "SEASPAN MONARCH" boarded the vessel at her berth, in North Vancouver at 1200 on June 4, 1986 and departed at 1315 bound for the Leader Avenue dock, making a short stop en route at a fuel dock.

The tug arrived at the Leader Avenue dock at 2030 and at 2115, after the non-propelled barge "SEASPAN 270" had been ballasted, went alongside and started to hook up the towing gear to prepare the barge for departure. Four other tugs were in attendance: the "SEASPAN DISCOVERY", "SEASPAN CHARGER", "SEASPAN TROJAN", and the "SEA CAP XII"; all were required to assist with the letting go of the mooring lines and the passage of the tug and tow through the New Westminster Railway bridge channel.

The "SEASPAN 270" was made fast and anchored alongside and outside of another barge; her mooring lines were made fast to the other barge and to the shore.

At 2315, the tug and barge departed from the Leader Avenue dock and proceeded downriver; the Fraser River level was about

6 m higher than normal as was usual for the time of year due to the melt and run off of inland snow and rain; the downstream current (freshet) was running at about 4 to 5 knots. High water at New Westminster had passed at 1853 with a fall of tide of 0.76 metre until low water which would occur at 2340, some 10 minutes after the incident.

The "SEASPAN MONARCH" proceeded at an estimated idling speed of 3 knots through the water with a following current of 4 to 5 knots. Therefore the tug and barge approached the open bridge channel at an approximate speed over the ground of 7 to 8 knots.

Shortly after departure, the tug "SEASPAN DISCOVERY" was directed by the towing tug "SEASPAN MONARCH" to make a bow line fast to the middle cleat on the stern of the barge in order to act as a stern tug and to check the barge in the event of an emergency. The tug "SEASPAN TROJAN", was directed to keep to the port side of the barge and the tug "SEA CAP XII" to take a position on the starboard bow; the tug "SEASPAN CHARGER" was positioned on the starboard side aft.

The "SEASPAN MONARCH" requested all the assist tugs by VHF radiotelephone not to touch the barge unless it became necessary.

The short run from the Leader Avenue dock to the New Westminster bridge was uneventful with the barge keeping a good course behind the towing tug. At the approaches to the railway bridge the downstream course of the river channel gradually turns from west to south-west and during freshets a north-westerly set of current is usually met; the "SEASPAN MONARCH" kept close to the two unlighted starboard hand buoys (S40 and S38) in order to counteract the above set and provide a proper alignment with the south channel of the rail bridge (see chartlet).

The first buoy (S40) was passed about 30 metres distant with the barge following the intended course. When in that location, or very shortly before, the stern tug engaged her two engines astern and kept them idling.

Midway between the two buoys, S40 and S38, the barge suddenly sheered towards the north side of the channel. The "SEA CAP XII" and the "SEASPAN CHARGER" immediately started to push her towards the south but because they were already entering the south channel and approaching the bridge, the assist tugs had to back off to avoid being caught between the bridge protection pier and the barge.

Their initial efforts to push the barge back to the south seem to have been partly successful because the starboard side of the barge's bow struck only a glancing blow to the south-east corner of the bridge protection pier followed by a blow to the

bridge swing span. The bow of the barge then swung to port and various helm and engine movements were made on the towing tug in order to re-align the barge with the channel through the bridge. The stern of the barge then swung to port and struck the south pier before clearing the bridge. The time of both contacts was 2330, June 4, 1986. There were no mechanical or navigational-aid malfunctions either during or prior to the incident.

The condition and operation of the swing span and piers was examined immediately following the striking; they were found not to be weakened and were considered fit for resumption of service about two hours later.

Analysis

1. Description of Bridge

The New Westminster Railway bridge (see plan) spans the Fraser River about 61 metres upstream from the Patullo Road bridge and includes a centre swing span of 131 metres in length. The swing span is pivoted at mid-length and when opened is situated above and parallel to a centre protection pier. The opened bridge clears the upstream navigation channel on the north side and the downstream navigation channel on the south side; each channel is approximately 49 metres wide.

The centre protection pier and the south resting piers are themselves protected by wooden cribs. The cribs consist of wooden piles driven into the river bed and encased by horizontal baulks of timber forming flexible walls. The walls are situated some 1.5 m outside of the concrete cores of the piers and are further supported by wooden cross braces. The purpose of the cribs is to absorb the force of any striking and so protect the concrete core and swing span.

The Transport Canada publication TP3446 E, titled "Vulnerability of Bridges in Canadian Waters" gives this particular bridge a pier vulnerability rating of 7, making it a high risk bridge as many of the piers are subject to striking either from deep sea vessels or barges under tow.

The New Westminster Railway Bridge is part of the Canadian National Railway main line to Vancouver and handles an average of forty trains daily carrying the bulk of commodities to and from the city.

2. Bridge Incidents

Since December 1975, the New Westminster Railway bridge has reportedly been struck eleven times, and all but one of the strikings were by barges under tow. In two cases, not including this casualty, the damage to the bridge was major.

The subject incident is the second striking of this bridge by the same barge.

In 1976 the same barge, on her first trip through the New Westminster Railway bridge, struck the bridge causing major damage. At the time it was felt that a larger and more powerful tug could better handle that size of barge. From 1976 until 1986 the barge made eight trips through the same location without incident.

The tug, "SEASPAN MONARCH" employed on this last occasion, is an ex-ocean-going tug of 41.86 m in length with a breadth of 9.48 m and an engine power of 2611 kW, almost double the power employed during the casualty in 1976.

3. Brief Description of the Barge "SEASPAN 270"

The "SEASPAN 270" is a non-propelled steel barge 121.92 metres long and 30.51 metres wide, her gross tonnage is 7692 and she is equipped with supports and side boxes for the carriage of lumber and various types of bulk cargoes. The barge is towed by two chains, called bridles, which lead from both sides of her bow and are joined at the ends by a triangular steel plate to which a third chain is attached. The tug's towing line is attached to the third chain.

The underdeck space of the barge consists of 16 watertight compartments, some of which can be filled or partially filled with ballast water to obtain a desired draught. The normal procedure to obtain a desired draught and trim is to pump in ballast water and on this occasion, compartment nos. 3,5 and 7 were partially filled to an approximate depth of 2.1 m, 2.3 m and 2.5 m, giving a mean draught of 2.4 m, a trim by the stern of 42 cm and a displacement, i.e. total weight, of approximately 9,000 tonnes.

4. Tide and Current

The Fraser River normally rises to its highest in June due to rain and melting inland snows. At New Westminster the incoming tidal stream is unable to reverse the current of the river during the freshet period, and on the day in question, the river height was 6.1 m above datum; the

strength of the current was reported to be between 4 and 6 knots in the vicinity of the railway bridge. During the freshets, the greatest rate of the outgoing stream occurs forty minutes before low water when it may amount to 6 knots. Since high water was to occur in New Westminster at 1850 as per the 'Canadian Tide and Current Tables' but only at 2110 from local experts and the passage was made at 2330 due to delays in departing with the barge, the time of passage was made approximately 4 1/2 hours by the tide book, or 2 1/2 hours from local expertise, after the tide had turned to ebb in New Westminster. High water is the period of least current at the bridge.

A short distance above the bridge, two currents merge following a bend in the river causing some disturbances in the current flow at the bridge position.

From Sapperton Dyke, two nautical miles upstream, the river flow turns from a westerly direction to a south-westerly direction. On an ebb tide there is a continuous lateral set towards the north shore and this set is more pronounced at freshet times, especially when the river is higher than 5.5 metres.

According to local expert evidence there are no reported cross-currents at the near approach to the New Westminster Railway Bridge but some towboat crews have mentioned that a barge will sometimes sheer on approach. The cause of this reported sheering has not been determined but the towing characteristics of the barge could be a factor. In this case, it appeared to some observers that the barge was set laterally, and to some others that the bow sheered to starboard when they were approximately 460 metres from the bridge.

5. Weather

Conditions were clear and the visibility was 5 nautical miles; the atmosphere, however, was dark. The wind was described as light airs and the waters were calm. Weather conditions are not considered to have been a factor in this incident but the darkness is.

6. Approach to the Bridge

The Fraser River Harbour Commission by-laws require that vessels passing through a draw (channel) of the Fraser River Railway bridge use the draw that lies to the port side of the vessel. There are two unlighted lateral red buoys S38 and S40, located approximately 245 metres and 490 metres upstream from the centre protection pier of the bridge which

must be passed at close proximity, especially during the spring freshet, in order to keep properly aligned with the south draw of the bridge.

The master of the towing vessel was steering and concentrating on keeping the tug in the proper position. By looking astern through the small after windows of the wheel-house, he could see the bow of the barge some 23 metres away. The second mate was standing at the engine controls and the bow of the barge was visible to him through a small door-window behind him.

There were four tugs in attendance; the most powerful had a bow line made fast to the middle stern cleat of the barge, one tug was on the port side and the other two were on the starboard side forward and midships.

Communications were maintained on VHF channel 65, the company channel, and were few and infrequent. The assist tugs were requested by the "SEASPAN MONARCH" not to touch the barge as a good approach to the bridge was being made. Shortly after, the barge seemed to sheer and drift laterally almost as fast as her forward speed. The assist tugs then started to push on the barge with all their power in a concerted effort to arrest her swing as it appeared that she was heading squarely for the middle pier. The stern tug was directed by radiotelephone to stop the barge but before anything could be done, the barge struck a glancing blow to the centre protection pier and at this late stage of the casualty it was decided to continue her passage.

No single person was in a position to have an overall view of the situation as the barge was unmanned and the masters on the assist tugs reacted independently when the problem became obvious. They were all experienced masters with a directive to assist the "SEASPAN 270" safely through the bridge draw, hence there was no preconceived plan of action or allocation of specific duties beyond the initial positioning of the tugs.

It is accepted that when approaching the railway bridge draw during the spring freshet, the two lateral buoys S38 and S40 must be hugged very closely as the northerly set, due to the river height, is very pronounced and must be counteracted continuously. The "SEASPAN 270" passed the buoys at a reported distance of approximately 30 metres and while opinions differ as to how far off the buoys should be passed, a distance of approximately 20 metres is normal.

It is further noted that during the freshet, with a current of between 4 to 6 knots, the buoys show little above the

water and it is very difficult to estimate the distance off the buoys at night.

7. Control of the Tow

The Fraser River Harbour Commission by-laws section 58(14) state:

> No vessel shall pass under the bridge or through the swing span unless the vessel and everything that it has in tow, are under complete control.

To be in complete control becomes more crucial when towing a non-propelled barge which has a total weight of 9,000 tonnes and is 30.5 m wide, through a bridge channel 49 m wide, leaving a little more than 9 m on each side of the barge with a 5 to 6 knot following current.

It would appear that the number of tugs on this occasion and their combined power would be considered more than sufficient to have the barge under complete control:

Assist Tugs

"SEASPAN DISCOVERY"	- power 2686 kW- Twin Screw
"SEASPAN CHARGER"	- power 634 kW- Twin Screw
"SEA CAP XII"	- power 671 kW- Twin Screw
"SEASPAN TROJAN"	- power 865 kW- Single screw

The "SEASPAN DISCOVERY" had a bow line made fast to the middle stern cleat of the barge and could have been used to check her, although it would have been difficult. The slowing down of the barge could have allowed more time for the tugs to push the barge towards the middle of the channel. A VHF call to the "SEASPAN DISCOVERY" to stop the barge came from one of the assist tugs but it was too late as the barge struck the bridge a few seconds later.

8. Certificates

All of the tugs involved in this incident were inspected by the Ship Safety Branch of the Canadian Coast Guard and had the required valid inspection certificates; their crews were also all properly certificated. The "SEASPAN 270" being an unmanned barge, was not required to have an inspection certificate by the regulations, nor did she have one.

9. Damage to the Barge

The damage to the starboard bow of "SEASPAN 270" consisted of her steel plating having been cut sharply by the steel

corner of the bridge for a length of 1.5 m and opened by approximately 4 cm. The opening was above the waterline and led to a void space which was about 30 cm below the raised deck of the bow. The port side of the stern came in contact with the south pier causing a dent of approximately 6 cm maximum in depth and covering an area of about 1.3 m by 1.3 m.

The barge was subsequently towed to Victoria where it was loaded on June 5, 1986, and towed to Esquimalt Dry Dock on the following day where repairs were made afloat by welding a steel doubling plate to the starboard bow prior to departing for Alaska.

10. Damage to the Bridge and Piers

The damage to the south-east corner of the protection pier indicated that the initial impact had occurred directly at the fender panel of the wooden crib at the end of the up-river side of the pier.

The damage to the protection pier was as follows: the under-water attachments for the fender panel were broken; the anchoring arrangements for the pilings were broken and displaced, and the top timber beam of the crib structure was broken.

The cumulative effect of the impact and the damage was observed to have loosened the pilings at the end and on the downstream side of the protection pier, causing those pilings to vibrate severely in the high and fast-flowing water.

It is assumed that in the striking, the perimeter crib pilings of the protection pier were deflected to such an extent as to permit the vessel to contact the corner of the swing span and displace the span so that it came to rest overhanging the north-east corner of the protection pier by approximately 1.5 m.

The corner of the swing span, having been deflected by about 1.5 m to the north, suffered only minor damage where three non-load carrying bolts were sheered and the vertical end plate was slightly buckled. There was a feather-like festoon of scorched paint shavings hanging on the corner of the swing span and the metal showed evidence of the heat generated during contact.

The protection pier and crib were effective in that they protected the railway bridge from major damage because they absorbed most of the force of the impact.

There was no damage incurred to the South Pier.

11. **Crew Experience**

The master of the "SEASPAN MONARCH" has 48 years experience at sea, 36 years as master on various tugs on the British Columbia Coast; the last 5 years were as master on the "SEASPAN MONARCH". He has navigated the Fraser River including the passage of the New Westminster Railway bridge on numerous occasions. He holds a Master Mariner Certificate issued at Victoria, B.C., in 1980.

The master of the "SEASPAN CHARGER" is the holder of a Master Home Trade, 350 Tons, Certificate issued in 1969 and has been seafaring for 30 years, always on tugs. He has been master for 18 years, on the "SEASPAN CHARGER" for the last 5 years and is based in New Westminster, B.C.

The master of the "SEASPAN TROJAN" is the holder of a Master Home Trade, 350 Tons, Certificate issued in 1970. He has been a master for 14 years on tugs in the Fraser River and has been assigned to the "SEASPAN TROJAN" for the past 8 months.

The master of the "SEASPAN DISCOVERY" has a Master Home Trade, 350 Tons, Certificate issued in 1951 and has 42 years experience at sea. He has been a master for 35 years on shift tugs mostly in the Fraser River.

The master of the "SEA CAP XII" has a Master Home Trade, 350 Tons, Certificate issued in 1973 but has been a master on tugs since 1965. He has worked for the same company since 1970 and may average as many as 20 trips daily through the Railway Bridge draw. He has 22 years experience on the Fraser River.

Findings

On June 4, 1986, the barge "SEASPAN 270" while being towed by the tug "SEASPAN MONARCH", and assisted by four other tugs, struck the New Westminster Railway bridge and protection pier due to an error in manoeuvring, causing damage to the structure and the barge.

It would appear that the following factors contributed to the striking:

- the barge is large in relation to the bridge channel, with a clearance of only some 9 m either side;

- the high freshet and the darkness;

- the passage was not made at the optimum state of the current because there was a delay in making the barge ready for departure;

- the master who had effective control of the operation also had the safety of his own tug to consider;

- there was a lack of pre-planning and thus a lack of effective control which, in turn prevented maximum use being made of the power available; and

- because of the size and design of the barge relative to the confines of the bridge passage, it is difficult to find a single standpoint from which to control the overall operation.

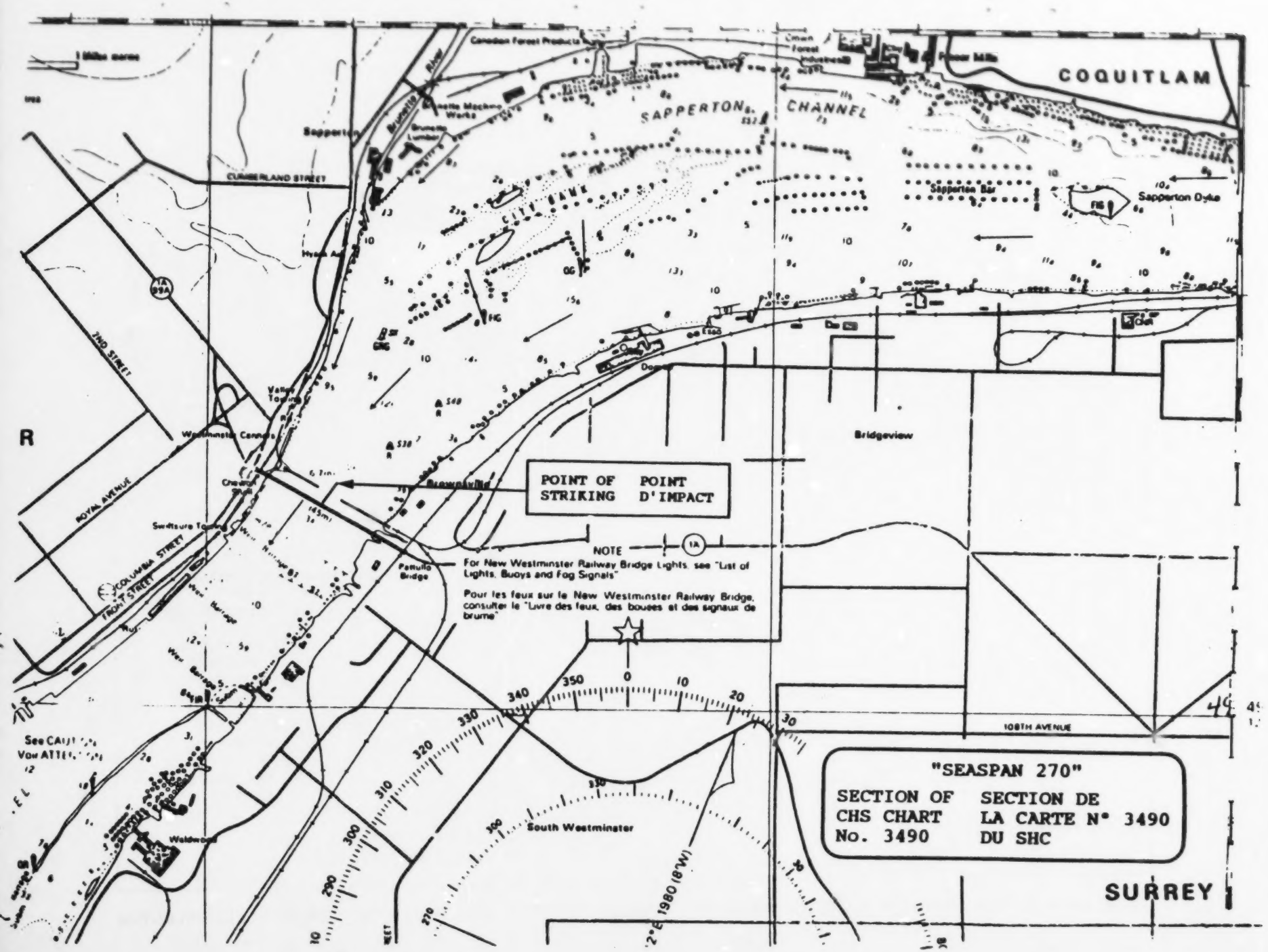
Other Findings

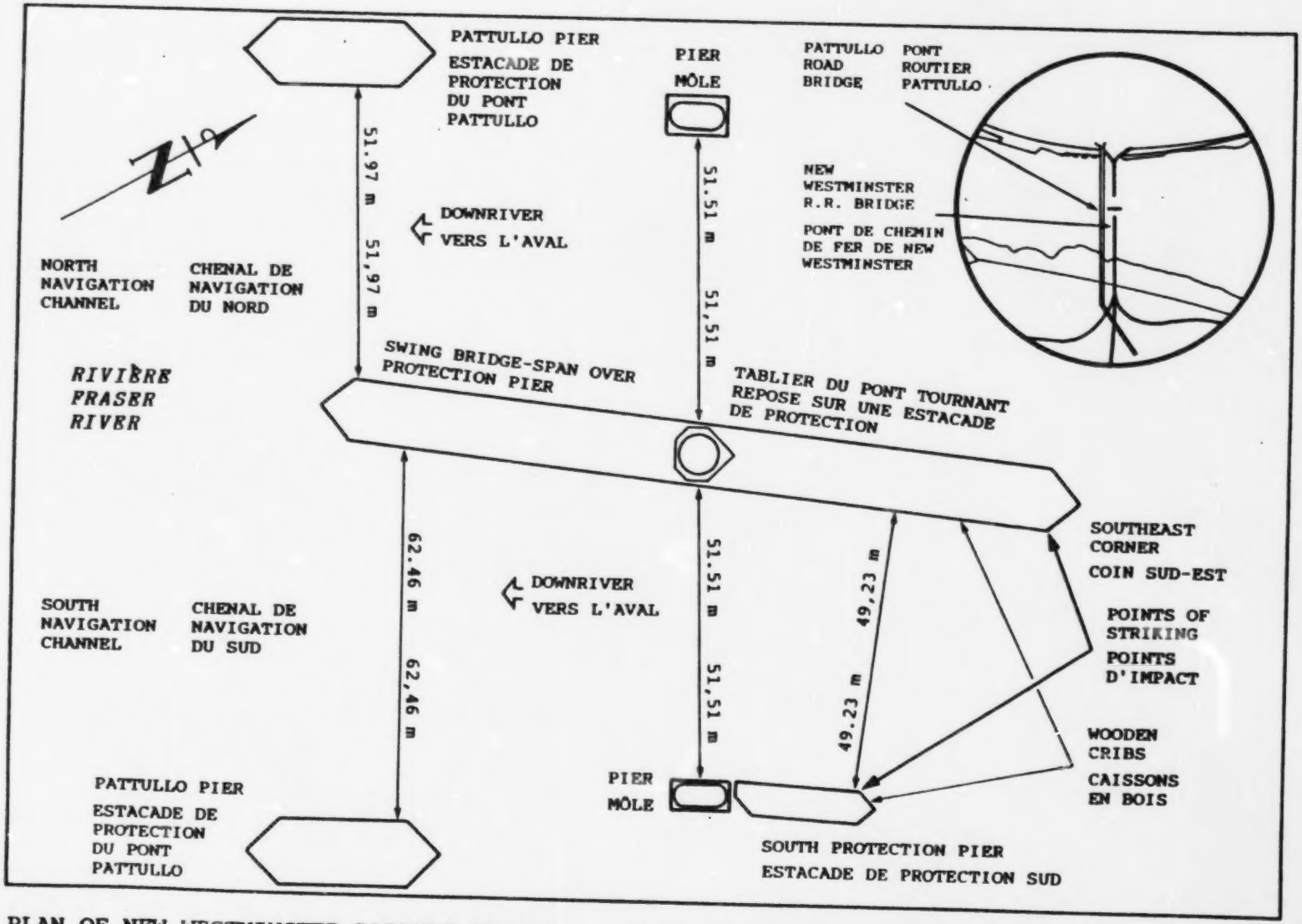
The protection pier for the bridge was effective in its purpose.

OTTAWA, ONTARIO
APRIL 1987.

Glossary

Ballast	In this case, water carried in the barge tanks to obtain a desired draught and trim
Bridle	A span of chain or rope with both ends secured. The hauling power is applied to the middle portion
Bulk Cargo	Usually a homogeneous cargo stowed in bulk, that is to say, loose in the hold and not enclosed in any container such as boxes, bales, bags, casks, and so on
Counteract	Steering the opposite way to defeat the effects of set
Doubling Plate	A second thickness of plating
Draw	The channel at the side of a swing-bridge to allow for navigable passage
Ebb Tide	Falling tide
Freshet	Rush of river water flowing into the sea, usually caused by heavy rain and/or melted snow
kW	1 brake horsepower = .736 kW
Set	(1) The direction in which a current is flowing, (2) A ship deflected from its steered course by a current is said to be set in the direction of the current
Sheer	To deviate from the line of course
Starboard-hand buoys	Buoys which should be kept to a vessel's starboard side when proceeding upriver and to port when proceeding downriver
U.T.C.	Co-ordinated Universal Time
VHF	Very High Frequency


COQUITLAM
SAPPERTON
CHANNEL
Sapperton Bar
Sapperton Dyke
CUMBERLAND STREET
2ND STREET
ROYAL AVENUE
COLUMBIA STREET
FRONT STREET
Bridgeview
POINT OF STRIKING
POINT D'IMPACT
NOTE
For New Westminster Railway Bridge Lights, see "List of Lights, Buoys and Fog Signals"
Pour les feux sur le New Westminster Railway Bridge, consulter le "Livre des feux, des bouées et des signaux de brume"
Pattullo Bridge
108TH AVENUE
South Westminster
SURREY
"SEASPAN 270"
SECTION OF CHS CHART No. 3490
SECTION DE LA CARTE N° 3490 DU SHC

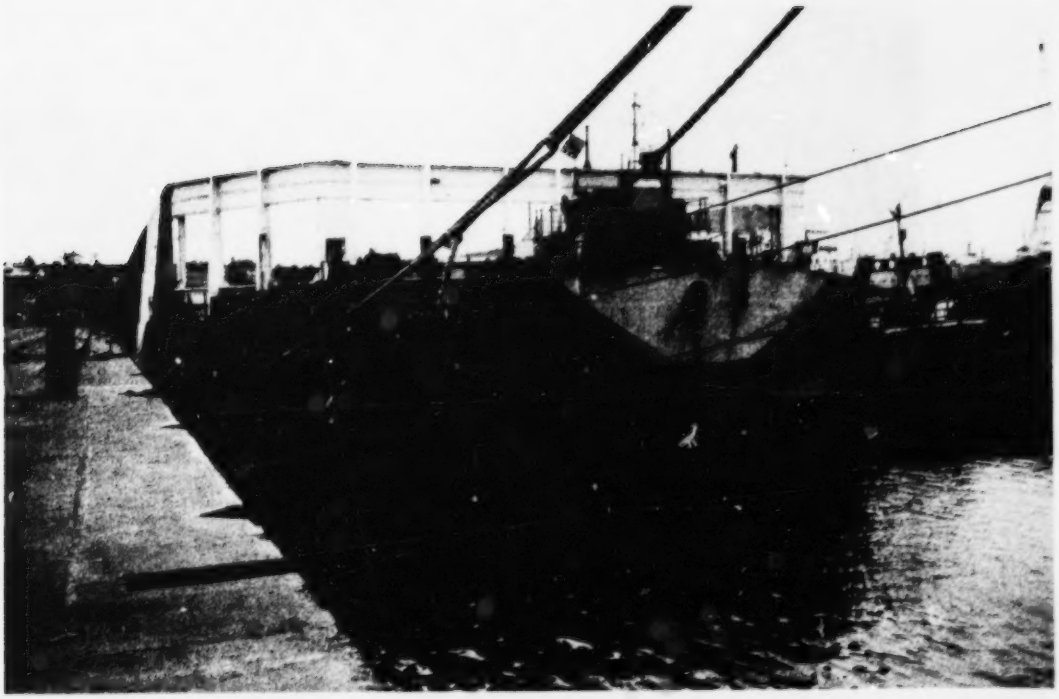


PLAN OF NEW WESTMINSTER RAILWAY BRIDGE

PLAN DU PONT DE CHEMIN DE FER NEW WESTMINSTER

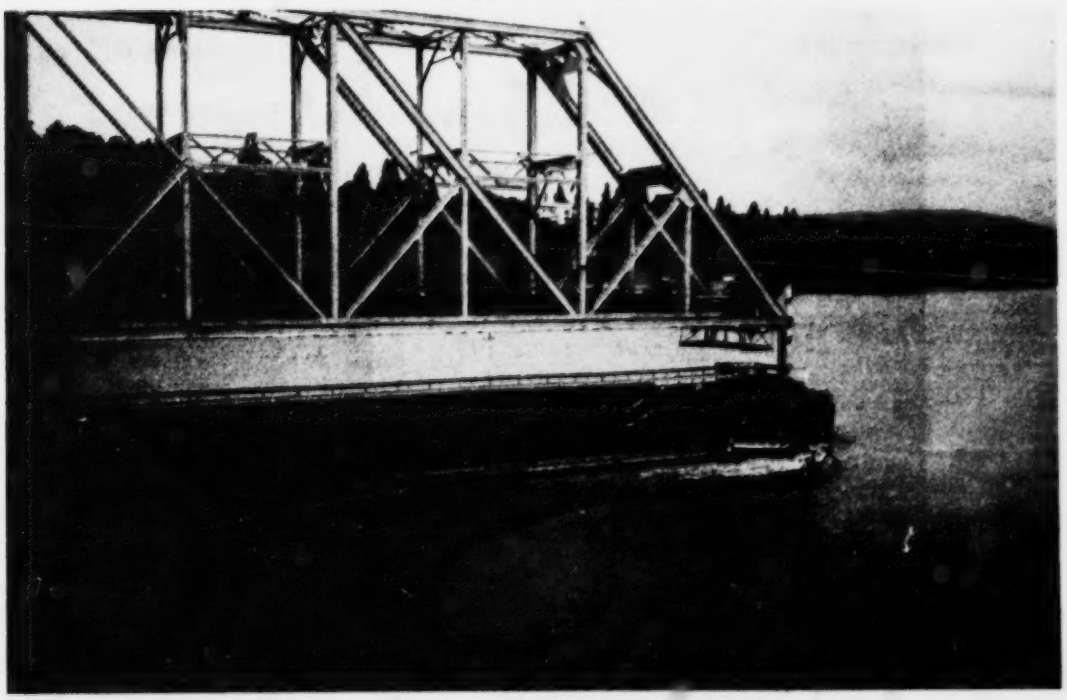
Barge "SEASPAN 270"

Chaland "SEASPAN 270"



NEW WESTMINSTER RAILWAY BRIDGE

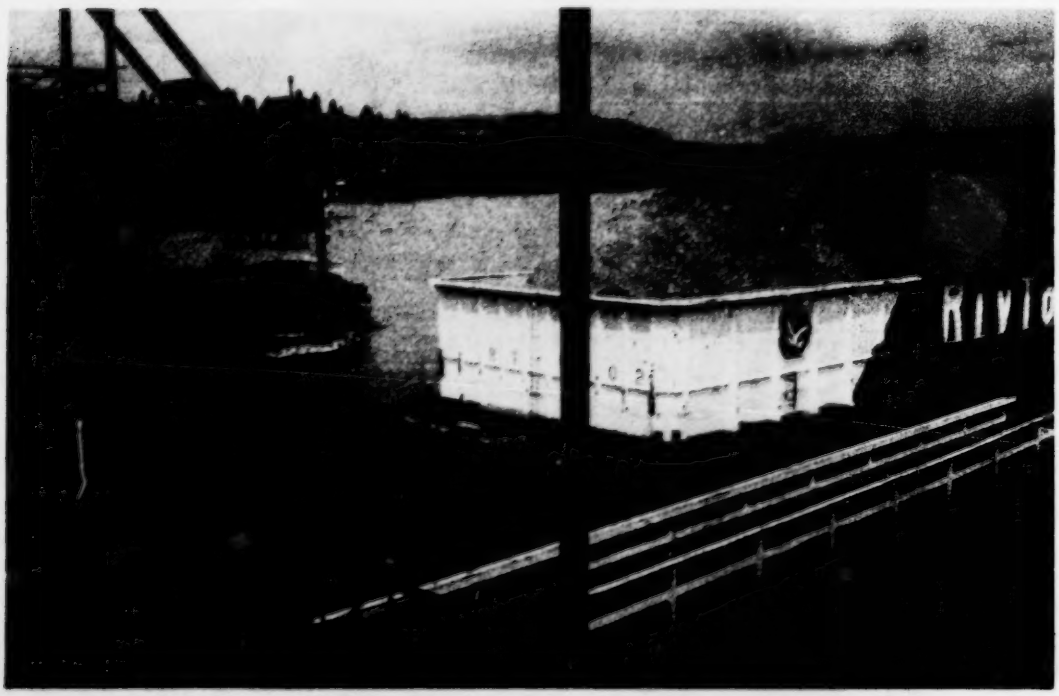
PONT DE CHEMIN DE FER NEW WESTMINSTER



Damaged corner Coin endommagé

"SEASPAN MONARCH" towing "SEASPAN 270" with same length of chain used when towing under bridge

"SEASPAN 270" remorqué par le "SEASPAN MONARCH" utilisant une remorque en chaine la même longueur que celle utilisée en passant sous le pont



A barge one-half the width of the "SEASPAN 270" being towed through the ship channel

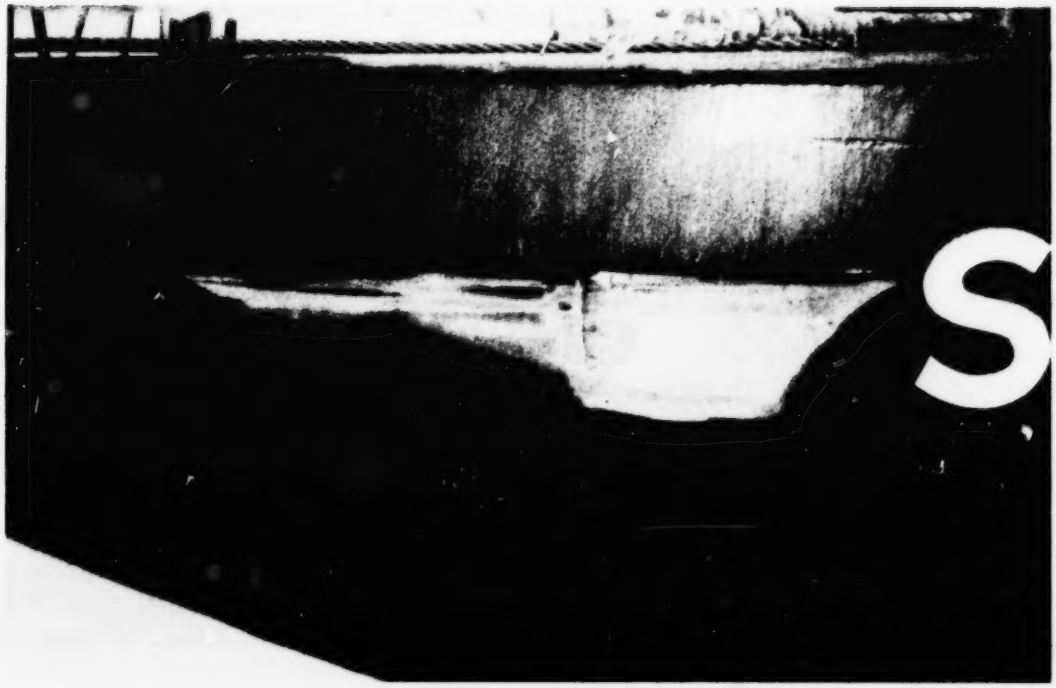
Un chaland une demie fois la largeur du "SEASPAN 270" remorqué dans le chenal de navigation

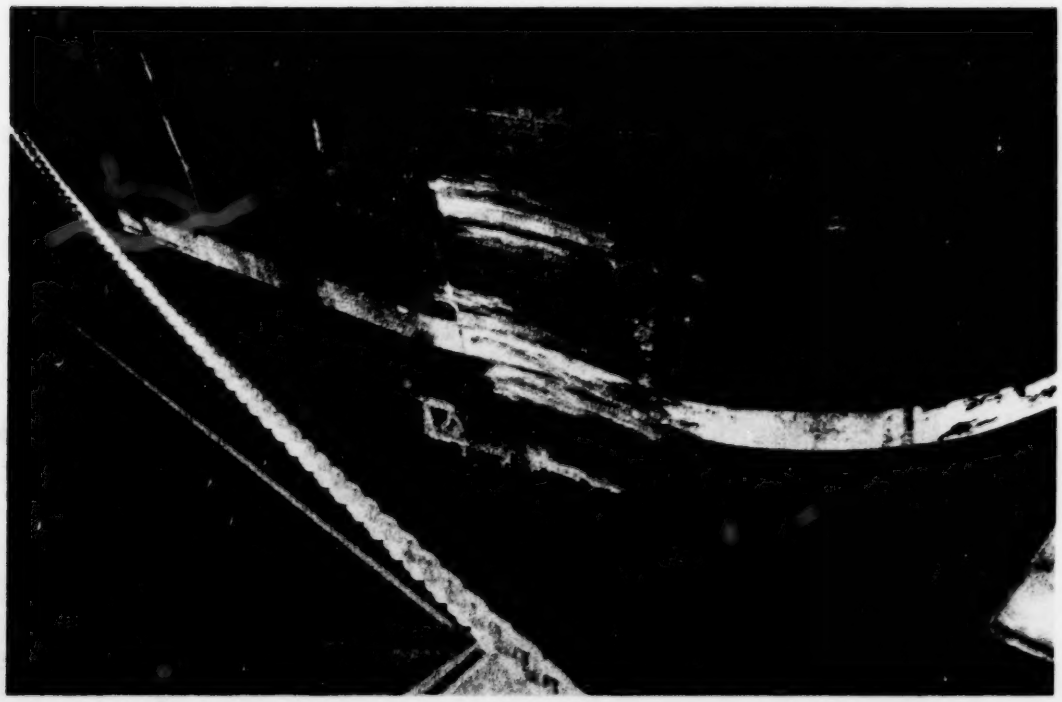
Damage to starboard bow.
Avaries à la proue sur tribord.

Damage to stern on port side.
Avaries à l'arrière sur bâbord.

Barge "SEASPAN 270"
Close-up of damage.

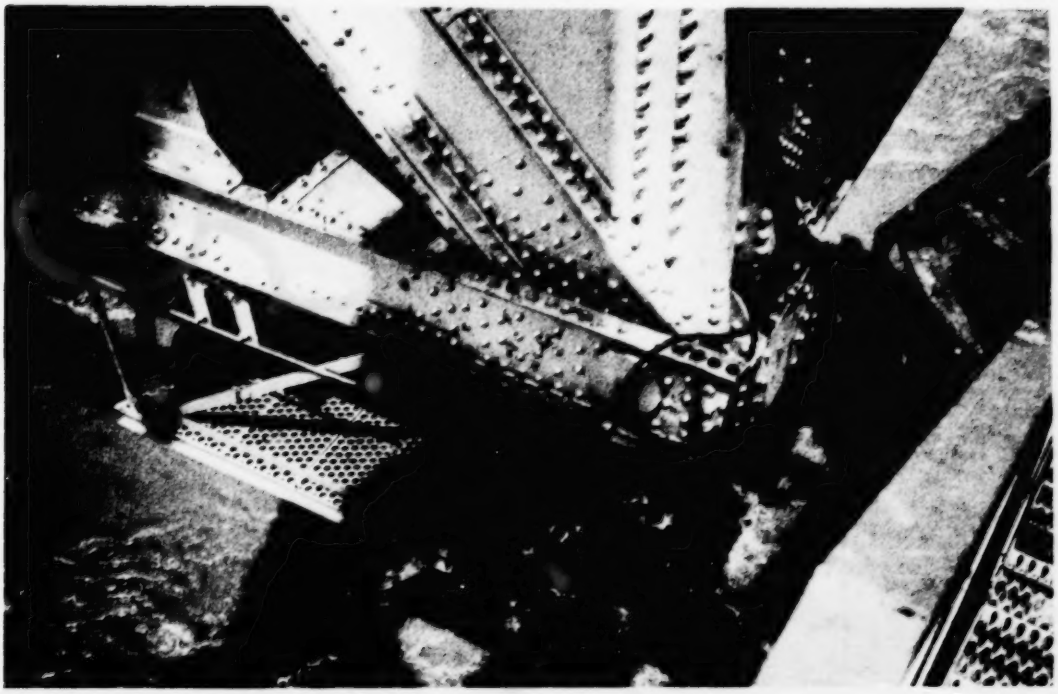
Chaland "SEASPAN 270"
Vue de près des avaries.



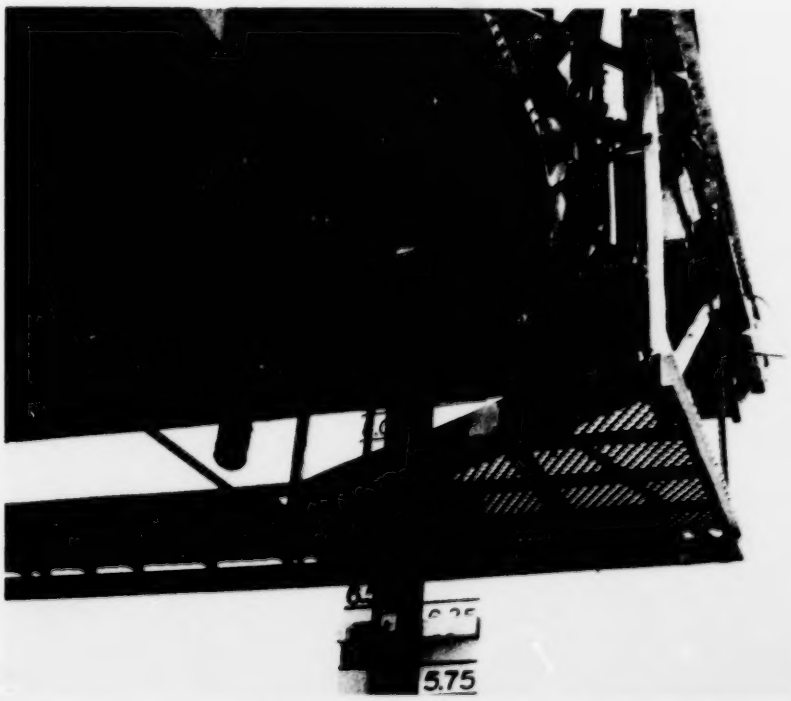


NEW WESTMINSTER RAILWAY BRIDGE
Bridge in open position

PONT DE CHEMIN DE FER NEW WESTMINSTER
Pont en position ouverte



Damaged corner Coin endommagé



Damaged corner Coin endommagé